

REMARKS

The Office Action mailed June 3, 2005, has been received and reviewed. Entry of the above amendment to the specification, which updates Government Rights in paragraph [0001] of the Present Application, is respectfully solicited. No new matter has been added. Claims 1-27 are currently pending in the application, of which claims 1-16 and 22-27 are currently under examination. Applicants herein acknowledge the restriction requirement in the above-referenced application and affirm the election to prosecute the claims of Group I (claims 1-16 and 22-27), without further traverse. Claims 17-21 are withdrawn from consideration as being drawn to a nonelected invention and have been canceled without prejudice or disclaimer to the filing of one or more divisional application(s) including the subject matter thereof. Claims 1-16 and 22-27 stand rejected.

Applicants have amended claims 1, 4, 8-16, 22, 23, 25, and 27 and respectfully request reconsideration of the application as amended herein.

35 U.S.C. § 102(b) Anticipation Rejections

Anticipation Rejection Based on U.S. Patent No. 6,232,265 to Bruening *et al.*

Claims 1-5, 7, 8, 10-15, and 25-27 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,232,265 to Bruening *et al.* ("Bruening"). Applicants respectfully traverse this rejection, as hereinafter set forth.

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Brothers v. Union Oil Co. of California*, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987). The identical invention must be shown in as complete detail as is contained in the claim. *Richardson v. Suzuki Motor Co.*, 9 U.S.P.Q.2d 1913, 1920 (Fed. Cir. 1989).

Bruening discloses a composition of a particulate solid support that includes a hydroxypyridinone-containing ligand that is covalently bonded to a solid support by a hydrophilic hydrocarbon spacer. Bruening at column 3, line 49 through column 4, line 14. The hydroxypyridinone-containing ligand includes three or more hydroxypyridinone ("HOPO") groups attached to a ligand carrier. *Id.* The solid support is an inorganic or polymeric organic

material, such as silica, silica gel, silicates, zirconia, titania, alumina, nickel oxide, glass beads, phenolic resins, polystyrenes, or polyacrylates. *Id.* at column 5, lines 8-12. The solid support is attached to the hydrophilic hydrocarbon spacer by a covalent linkage mechanism. *Id.* at column 4, lines 8-14. The particulate solid support is used to selectively bind transition metal ions, post-transition metal ions, actinide metal ions, or lanthanide metal ions, from a source solution. *Id.* at column 6, lines 6-17.

Example 3 of Bruening discloses the preparation of tetrakis (5-amino-2-oxapentyl)methane as the ligand carrier. *Id.* at column 8, line 22 and column 9, lines 12-67. Tetrakis (5-amino-2-oxapentyl)methane is synthesized from pentaerythritol and acrylonitrile ($\text{CH}_2=\text{CHCN}$) using an Ag/KOH catalyst. *Id.* at column 9, lines 26-29. During the reaction to form a tetranitrile product, excess acrylonitrile is polymerized and removed by filtration. *Id.* at column 9, lines 32-35. The polymer is washed with chloroform, and the chloroform layer is washed with water and dried to provide the tetranitrile product. The tetranitrile product is further reacted to produce the tetrakis (5-amino-2-oxapentyl)methane. *Id.* at column 9, lines 37-66.

Bruening does not expressly or inherently describe each and every element of independent claim 1 because Bruening does not disclose the elements of “dissolving polyacrylonitrile (PAN) into the metal solution to form a PAN-metal solution” and “depositing the PAN-metal solution into a quenching bath to form an adsorption medium.” The Examiner asserts that Bruening discloses these elements in Example 3. Office Action of June 3, 2005, p. 4. However, Example 3 of Bruening does not expressly or inherently describe dissolving PAN into the metal solution to form a PAN-metal solution, as recited in claim 1. Instead, the cited section discloses that the pentaerythritol and the acrylonitrile are reacted to form a tetranitrile product. Excess acrylonitrile in this reaction is allowed to polymerize and is filtered from the reaction. While the excess acrylonitrile is polymerized, this polymerized acrylonitrile is not dissolved into a metal solution to form a PAN-metal solution. Rather, the polymerized acrylonitrile is removed from the reaction mixture before proceeding with the remainder of the reaction that produces the tetranitrile product. Since the acrylonitrile is in a unpolymerized or monomeric form when it is added to the mixture of pentaerythritol and the Ag/KOH catalyst, it is improper for the Examiner to characterize this acrylonitrile as PAN.

Bruening also does not expressly or inherently describe the element of “depositing the PAN-metal solution into a quenching bath to form an adsorption medium.” While Bruening discloses adding acrylonitrile to water, at this stage of the reaction, the acrylonitrile is a monomer and is not polymerized. As such, a solution of the acrylonitrile is not properly characterized as a PAN-metal solution. In addition, the mixture of pentaerythritol, acrylonitrile, and the Ag/KOH catalyst does not form an adsorption medium when the components are reacted. Rather, this mixture forms an intermediate tetranitrile product, which is further reacted to form tetrakis (5-amino-2-oxa-pentyl)methane as a ligand carrier for the particulate solid support.

Since Bruening does not expressly or inherently describe each and every element of claim 1, the anticipation rejection of claim 1 is improper and should be withdrawn.

Claims 2-5, 7, 8, and 10-15 are allowable, *inter alia*, as depending from an allowable base claim.

Claim 7 is further allowable because Bruening does not expressly or inherently describe dissolving the at least one metal compound in concentrated nitric acid. The Examiner relies on Example 12 of Bruening as disclosing this element. However, Example 12 discloses that an aqueous solution of nitric acid is used as a receiving liquid to form a stronger complex with the carrier ligand.

Claim 10 is further allowable because Bruening does not expressly or inherently describe spraying a PAN-metal solution into a quenching bath that includes an alkaline agent to form the adsorption medium. The Examiner appears to rely on the presence of the Ag/KOH catalyst in Bruening as disclosing this element. Office Action of June 3, 2005, p. 4. However, the Ag/KOH catalyst catalyzes the reaction of Bruening and is not present in a quenching bath in which the PAN-metal solution is sprayed to form the adsorption medium.

Claim 11 is further allowable because Bruening does not expressly or inherently describe spraying a PAN-metal solution into a quenching bath that comprises from approximately 0.1M sodium hydroxide to approximately 8M sodium hydroxide to form the adsorption medium for substantially the same reasons as discussed for claim 10.

Claim 12 is further allowable because Bruening does not expressly or inherently describe precipitating at least one metal hydroxide from the PAN-metal solution and insolubilizing the

PAN in the PAN-metal solution.

Claim 13 is further allowable because Bruening does not expressly or inherently describe producing a solid bead that comprises at least one metal hydroxide incorporated into the PAN. Rather, the beads in Bruening include particulate solid supports having hydroxypyridinone-containing ligands covalently bonded to a solid support by a hydrophilic hydrocarbon spacer. As previously discussed, any PAN that is produced during the reaction in Example 3 is subsequently removed and, therefore, is not formed into a solid bead that comprises at least one metal hydroxide incorporated into the PAN.

Claim 14 is further allowable because Bruening does not expressly or inherently describe impregnating a support with the adsorption medium. The Examiner relies on the Abstract as disclosing this element. While the Abstract discloses passing a source solution that contains ions to be separated over a column of the particulate solid supports, the Abstract of Bruening does not disclose a support impregnated with the defined adsorption medium.

Claim 15 is further allowable because Bruening does not expressly or inherently describe impregnating a support with the at least one metal hydroxide incorporated into the PAN for substantially the same reasons as discussed above for claims 13 and 14.

Bruening does not expressly or inherently describe each and every element of independent claim 25 because Bruening does not disclose the elements of “dissolving polyacrylonitrile (PAN) into an organic solvent to form a PAN solution,” “adding at least one metal oxide to the PAN solution to form a metal oxide-PAN solution,” and “depositing the metal oxide-PAN solution into a quenching bath to form an adsorption medium.” Specifically, Bruening does not disclose dissolving PAN into an organic solvent to form a PAN solution because the acrylonitrile in Bruening is dissolved in water. Furthermore, as previously discussed, the acrylonitrile is in a monomeric form when it is added to water and, therefore, is not properly characterized as PAN. Bruening also does not disclose adding at least one metal oxide to the PAN solution to form a metal oxide-PAN solution because, as previously described, any PAN that is formed in Bruening is removed from solution before subsequent reactions are conducted. Finally, Bruening does not disclose depositing the metal oxide-PAN solution into a quenching

bath to form an adsorption medium for substantially the same reasons as discussed above for claim 1.

Claims 26 and 27 are allowable, *inter alia*, as depending from an allowable base claim.

Claim 26 is further allowable because Bruening does not expressly or inherently describe adding at least one powdered metal oxide to the PAN solution. The Examiner states that claim 4 of Bruening discloses this element. While claim 4 of Bruening discloses that the inorganic solid support is an oxide, nothing in Bruening discloses that a powdered metal oxide is added to the PAN solution.

Claim 27 is further allowable because Bruening does not expressly or inherently describe depositing the metal oxide-PAN solution into a water bath. The Examiner relies on Example 3 as disclosing this element. While Example 3 discloses adding acrylonitrile to water, the acrylonitrile is a monomer at this stage of the reaction and is not polymerized. In addition, any polymerized acrylonitrile that is formed is subsequently removed and is not formed into an adsorption medium.

35 U.S.C. § 103(a) Obviousness Rejections

Obviousness Rejection Based on Bruening

Claims 6, 9, 16, and 22-24 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Bruening. Applicants respectfully traverse this rejection, as hereinafter set forth.

M.P.E.P. 706.02(j) sets forth the standard for an obviousness rejection:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

The obviousness rejection of claims 6, 9, 16, and 22-24 is improper because the cited

references do not teach or suggest all of the claim limitations.

The teachings of Bruening are as previously described.

Claims 6, 9, and 16 are allowable, *inter alia*, as depending from an allowable base claim, namely independent claim 1.

Claim 9 is further allowable because Bruening does not teach or suggest that from approximately 3% by weight to approximately 5% by weight of PAN is dissolved into the metal solution. Rather, as previously discussed, acrylonitrile, not PAN, is dissolved into solution in Bruening. Furthermore, any PAN that is formed during the reaction in Example 3 of Bruening is removed.

Claim 16 is further allowable because Bruening does not teach or suggest producing an adsorption medium that has from approximately 10% by weight to approximately 85% by weight of a metal in the form of an elemental metal or the at least one metal hydroxide and from approximately 15% by weight to approximately 90% by weight of the PAN. The Examiner states that this limitation “would have been obvious to one of ordinary skill in the art at the time the invention was made . . . because Bruening ‘265 discloses 40% Ag/KOH and removal by filtration, which would obviously, to one of ordinary skill, at least suggest 10-85% of Ag after removal of liquid by filtration with a balance of polyacrylonitrile.” Office Action of June 3, 2005, p. 5. However, even assuming *arguendo* that the Examiner’s reasoning is correct, the claimed invention still would not be taught or suggested because nothing in Bruening teaches or suggests an adsorption medium having the recited weight percentages of metal and PAN. Rather, the particulate solid support of Bruening includes hydroxypyridinone-containing ligands that are covalently bonded to a solid support by a hydrophilic hydrocarbon spacer. As previously discussed, any PAN that is formed during the reaction in Example 3 is removed and, therefore, is not incorporated into the particulate solid supports of Bruening.

Bruening also does not teach or suggest all of the limitations of independent claim 22. Specifically, Bruening does not teach or suggest that the adsorption medium comprises “a polyacrylonitrile (PAN) matrix and at least one metal hydroxide.” As previously discussed, while Example 3 in Bruening discloses polymerized acrylonitrile, the polymerized acrylonitrile is not incorporated into a matrix of an adsorption medium. Rather, the polymerized acrylonitrile is

removed before subsequent reactions are conducted to form a tetrakis (5-amino-2-oxapentyl)methane ligand. The disclosure of Bruening describes a ligand, a solid support, a hydrophilic hydrocarbon spacer, and a covalent linkage mechanism. However, since the particulate solid supports in Bruening do not include PAN, Bruening necessarily does not teach or suggest the limitation of the adsorption medium "having from approximately 10% by weight to approximately 85% by weight of a metal in the form of an elemental metal or the at least one metal hydroxide and from approximately 15% by weight to approximately 90% by weight of the PAN."

Claims 23 and 24 are allowable, *inter alia*, as depending from an allowable base claim.

Claim 24 is further allowable because Bruening does not teach or suggest that the at least one metal hydroxide is substantially homogeneously dispersed in the PAN matrix.

ENTRY OF AMENDMENTS

The amendments to claims 1, 4, 8-16, 22, 23, 25, and 27 should be entered by the Examiner because the amendments are supported by the as-filed specification and drawings and do not add new matter to the application.

CONCLUSION

Claims 1-16 and 22-27 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain that might be resolved by a telephone conference, the Examiner is respectfully invited to contact Applicants' undersigned attorney.

Respectfully submitted,



Stephen R. Christian
Registration No. 32,687
Attorney for Applicants
P.O. Box 1625
Idaho Falls, ID 83415 – 3899
Phone: 208-526-9140
Fax: 208-526-8339

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